~~SECRET~~ CONFIDENTIAL

Office Memorandum • UNITED STATES GOVERNMENT

TO : The Files DATE: 14 November 1956

FROM : [redacted] 25X1

SUBJECT: (Trip Report, Contract RD-107, Task Order 4,

1. On 5 November 1956 a meeting was held at [redacted] 25X1 [redacted] to discuss the subject contract. Present at 25X1 the meeting were:

[redacted] 25X1

2. Testing of the ferrite antenna under load has disclosed some unexpected and discouraging results. Design efforts to this time have been directed towards achieving maximum effective height (open circuit voltage output) and have been successful. However, upon testing under the specified 72 ohm load it was learned that placing a number of ferrite antennas close together in a matrix did not substantially improve the power output over a single ferrite antenna. It is now believed that there is only a certain amount of energy of a given bandwidth in a given area and that either an air-core loop or an ideal ferrite antenna efficiently collects almost all of that energy. Putting more antennas in the same area will not help; also, if a matrix of ferrite antennas is formed in which each ferrite efficiently collects the energy in its area, the resulting sensitivity will not be greater than the sensitivity of an air-core loop which has an area equal to that of the matrix. The only exception to this rule is the case shown at the end of this report in which two ferrite rods are placed a loop diameter apart. In this case each ferrite captures an area equal to that within the loop yielding a sensitivity twice that of the loop but enclosing a square area slightly greater than the round area enclosed by the loop. Again adding a third ferrite between the first two would not improve the pick-up since its capture area would over-lap with the two outside ferrites.

3. It has also been determined that the present ferrites are not ideal. While the effective height of ferrite loops is considerably greater than that of an air-core loop, the power output is less than half of the equivalent air-core loop. The tabulation below presents power output of a number of antennas, each of which are loaded to yield a 2 kc bandwidth at 20 kc.

DOC 9 REV DATE 1 APR 1980 BY 064540
ORIG COMP 033 OPI 56 TYPE 02
ORIG CLASS S PAGES 3 REV CLASS C
JUST 22 NEXT REV 2010 AUTH: HR 70-2

CONFIDENTIAL

~~SECRET~~

Antenna (single loop or ferrite rod)	Power Out Microwatts	Permeability (intrinsic or toroidal)	Q (Unloaded)	
15" dia. air-core	7.9	1	25	
[redacted] Ferrite ½" x 15"	3.6	300	200	25X1
Ferramic G ¼" x 8"	.5	200	225	
Ideal Ferrite ½" x 15"	8		150	

It can be seen that the best [redacted] could do was 3.6 microwatts and even an ideal ferrite with infinite permeability would only slightly exceed the air-core loop. It is believed that these results were obtained because power output, P_o: 25X1

$$P_o = \frac{(e_i)^2\, Q_{(loaded)}}{\omega L}$$

The effective height as measured by the induced voltage, ~~e.i.~~ e_i, of the ferrite antenna was high but the inductive reactance of the ferrites is also very high.

4. In summary, it has been determined that for a given bandwidth, placing cores close together in a matrix will not yield a sensitivity greater than that of an air-core loop with an area the same as the matrix. It has also been determined that for a 2 kc bandwidth, the present ferrite antennas are only half as sensitive as an air-core loop which has a diameter the same as the ferrite length and that the ideal antennas could only equal the air-core loop.

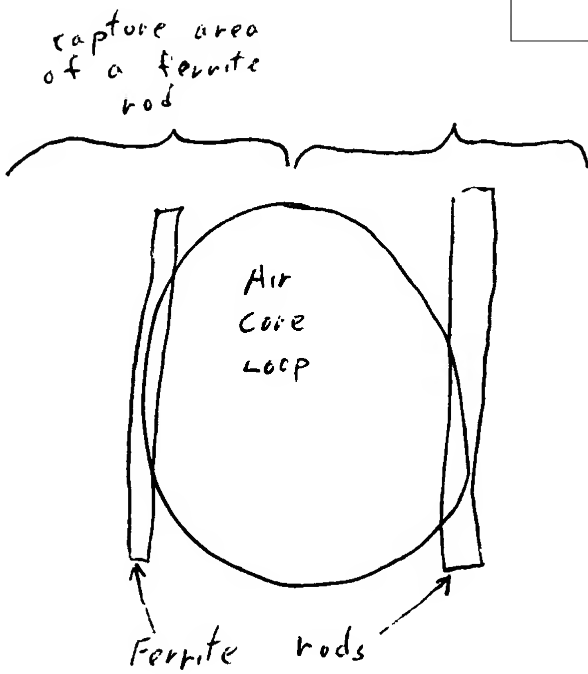
5. Because of these results, all work on this project has stopped pending instructions from us as to what further action is desired. At this time approximately $6,000.00 of the money allocated remains unspent. Approximately thirty (30) specially fabricated ferrite rods are on hand. These rods are ½" in diameter and 15" long, and up to frequencies of one megacycle, maintain a Q of 200 and toroidal permeability of 300.

6. It should be noted that there are certain advantages of single ferrite rods which must be weighed against the fact that they are half as sensitive as the equivalent air-core loop. Under certain circumstances, a round ferrite rod ½" in diameter by 15" long may be easier to conceal than an air-core loop 15" in diameter. Also, referring to the equation given in Paragraph 3, it can be seen that as Q goes up (and bandwidth decreases) power output goes up. The highest Q obtainable in an air-core loop is roughly 50 (yielding a bandwidth of 400 cycles) and its' sensitivity could be equaled by a ferrite antenna with a Q of 100 (bandwidth of 200 cycles).. By using the maximum Q possible, 200, a ferrite antenna would be twice as sensitive as an air-core antenna but would have a

bandwidth of only 100 cycles at 20 kc. Also, two ferrite antennas will not interact if they are tuned to resonate far enough apart. Using their high Q characteristics in this manner, it would be possible to build a matrix of a number of ferrite antennas tuned to different frequencies which would be more sensitive than an air-core loop of equivalent area but the frequency response characteristics would probably have "suck outs" roughly 10 db deep. Also, the ferrite is more directional than the air-core loop and under some circumstances it is possible to eliminate interference from local sources such as electric motors by using this characteristic.

[redacted] 25X1

[redacted] 25X1



Declassified in Part - Sanitized Copy Approved for Release 2012/04/10 : CIA-RDP78-03424A000500010011-5